# TAXONOMIC STUDIES ON THE GENUS *GRANDIDIERELLA* COUTIÈRE (CRUSTACEA: AMPHIPODA), WITH A DESCRIPTION OF *G. DENTIMERA*, SP. NOV.

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ABSTRACT

The systematic position of specimens of *Grandidierella* from the Gulf of Mexico and the Caribbean, attributed variously by workers to *G. bonnieri* Stebbing and *G. bonnieroides* Stephensen, is discussed and compared with type-material of *G. bonnieri* Stebbing. *G. dentimera*, sp. nov., from Hawaii is fully described and figured, and the known geographical range of *G. perlata* Schellenberg is extended to Micronesia.

## INTRODUCTION

Amphipods of the genus *Grandidierella* Coutière characteristically occur in brackish waters, where they construct tubes on a variety of hard substrates. The first gnathopoda of the males are always greatly enlarged and carpochelate, while the second gnathopoda are usually slender and setose. The setose second gnathopoda are mainly responsible for filtering out the detritus, upon which the animals feed, from the water current that passes through the tube and which is initiated and maintained by the metachronally beating pleopoda. Setae located on the basipodites of some of the peraeopoda may also assist in the filtration process. Certain members of the genus have succeeded in penetrating fresh waters, while others are found under true marine conditions. The genus is circumtropical in distribution.

Extensive literature exists on the genus, yet there is still confusion concerning the delimitation of some of the species. Perhaps the group of species which has presented the most difficulties to taxonomists has been that containing *G. bonnieri* Stebbing, *G. bonnieroides* Stephensen, and *G. mahafalensis* Coutière. Ruffo (1958) demonstrated that *G. mahafalensis* was distinct from *G. bonnieri*, but the distinctness of *G. bonnieroides* has remained questionable.

Generous loans of neotropical material from Dr. T. E. Bowman (United States National Museum), Dr. J. Forest (Museum National D'Histoire Naturelle, Paris), and Dr. T. Wolff (Universitetets Zoologiske Museum, Denmark), together with personally collected specimens from the East African coast, have enabled me to investigate the systematics of the

TABLE 1

THE OCCURRENCE OF STERNAL PROCESSES ON PERAEON SEGMENTS 1 AND 2 OF *Grandidierella bonnieroides* STEPHENSEN
(++, prominent; +, very reduced or vestigial; –, absent)

| Locality | Peraeon seg. 1 | Peraeon seg. 2 |
|---|---|---|
| Marguerita Island, Venezuela | ++ | + or – |
| Gran Roque Island, Venezuela | ++ | + or – |
| Sta. Marta Island, Colombia | ++ | ++ |
| "West Indies" | – | – |
| Tortola Island, West Indies | ++ | ++, + or – |
| Caroni Swamp, Trinidad, West Indies | ++, + or – | + or – |
| Cuba (Shoemaker, 1948) | ++ | ? |
| Bonaire, Curaçao, West Indies | – | – |
| Port St. Joe, Florida | ++, + or – | + or – |
| Marion County, Florida | ++ | + or – |
| Lake Pontchartrain, Louisiana | ++ | + or – |
| Baffin Bay, Texas | ++ or + | + or – |
| Suez (Schellenberg, 1928) | ++ | ?– |
| Msasani Bay, Tanzania | ++ | ++ |
| Durban Bay, Richards Bay, St. Lucia Bay, South Africa (Barnard, 1951, 1952) | ++ | ++ |
| Soalara, Madagascar (Ruffo, 1958) | ++ | ++ |
| Vizagapatam, Travancore, Cochin, India (Barnard, 1935) | ++ | ++ |
| Cooum & Adyar backwaters, Madras, India (Nayar, 1959) | ++ | ++ |

*G. bonnieri-bonnieroides* complex, to describe a new species, *G. dentimera*, from Hawaii, and to extend the known distribution of *G. perlata* Schellenberg.

## HISTORICAL REVIEW

Stephensen (1933) first recorded the genus *Grandidierella* from the Americas, from the island of Bonaire in the West Indies, and concluded that his material was referable to *G. megnae* (Giles). Later (Stephensen, 1948), he revised his diagnosis and referred his original material, together with further material from Bonaire and Curaçao, to a new species, *G. bonnieroides* Stephensen, which he distinguished from *G. bonnieri* Stebbing on the following characters: article 5 of the male gnathopod 1 parallel-sided (not oval) and bearing three (not one) spinous processes; male gnathopod 2 having article 5 longer than article 6 (not subequal); article 5 of the female gnathopod 2 less oval; and minor differences in the

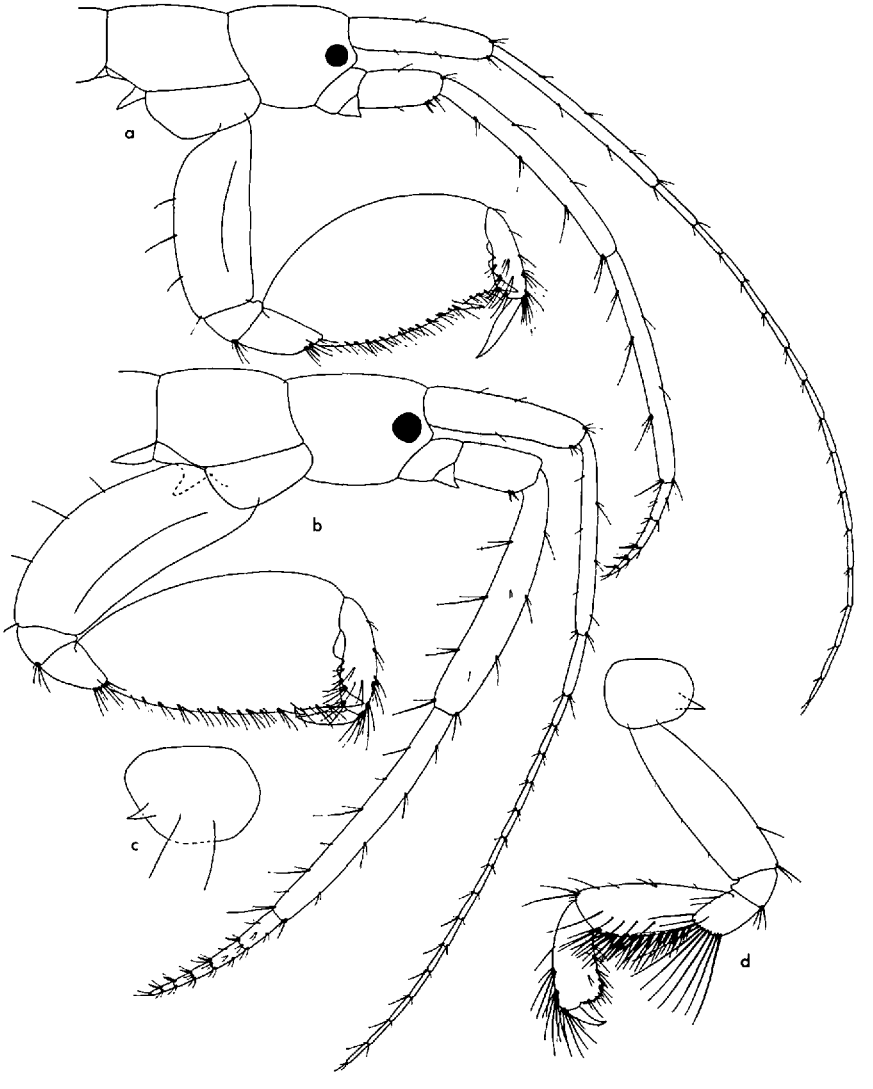
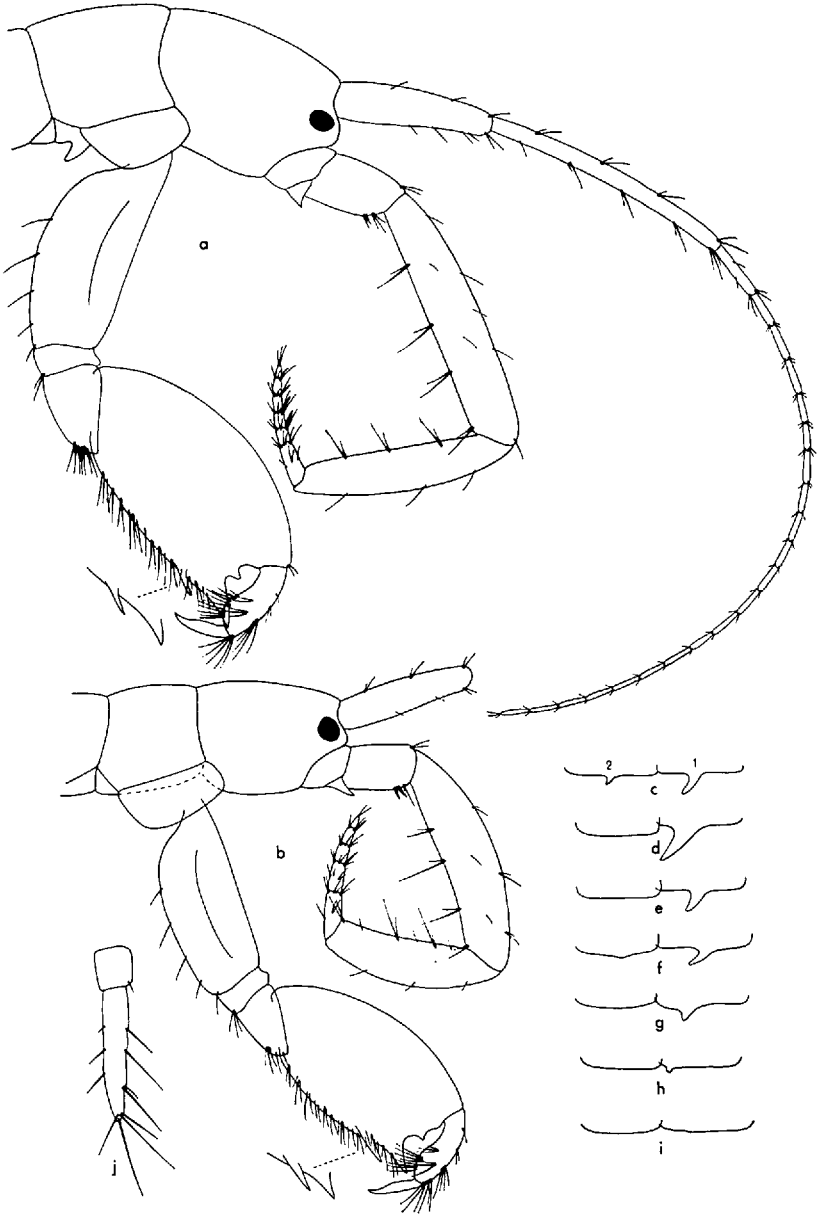



FIGURE 1. *Grandidierella bonnieroides* Stephensen: a, anterior end of male, Marguerita Island, Venezuela; b, anterior end of male, Sta. Marta Island, Colombia; c, coxa 2, male, Caroni Swamp, Trinidad; d, gnathopod 2, male, Marion County, Florida.


a
b
c
d
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2
1

antennules and antennae. In addition, he distinguished *G. bonnieroides* from *G. bonnieri* of Barnard (1935) by the complete absence of sternal spines. In the same year, Shoemaker (1948) described a species of *Grandidierella* from Cuba which he referred to *G. bonnieri* Stebbing. His figures do not differ significantly from those of Stephensen (1948) for *G. bonnieroides*, except for the presence of sternal processes in the peraeon region, and the slightly more ovoid article 5 of the male gnathopod 1.

## Discussion

Present investigations on material from the Caribbean and Gulf of Mexico show a considerable variation in the relative development of the sternal processes (Table 1; Fig. 2, c-i). The process on peraeon segment 1 is usually present and occasionally very well developed, while that on peraeon segment 2 is usually absent, although occasionally relatively well developed. Article 5 of the male gnathopod 1 is subject to small variations of shape; some specimens resemble the figures of Stephensen (1948) for *G. bonnieroides* Stephensen, whilst others are similar to the rather ovoid condition figured by Shoemaker (1948) for *G. bonnieri* Stebbing. However, intergrades between the two types are common. A further source of variation in present material is the form of the antenna (antenna II), which may be very robust and subpediform (Fig. 2, a, b) or relatively slender (Fig. 1, a, b). But here again, intermediates occur.

In all the variations described above, individual populations tend to show a high conformity for a particular character, suggesting that most of the populations are genetically distinct. Throughout all the forms, however, there is constancy in the configuration of teeth on article 5 of the male gnathopod 1. There are always three teeth; the largest is at the posterior distal angle, with a smaller tooth anterior to it distally, and a further tooth proximal to it. This latter arises within the posterior margin and protrudes somewhat laterally, so it can easily be overlooked if the appendage is flattened on a slide. Since the species of *Grandidierella* are characteristically inhabitants of brackish waters, one might expect speciation through isolation to occur more readily than in fully marine forms, where geographical isolation is usually less apparent. However, *G. bonnieroides* is known to occur under fully marine conditions as well as in brackish waters, so salinity

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Figure 2. *Grandidierella bonnieroides* Stephensen: a, anterior end of male, Marion County, Florida; b, ditto, "West Indies"; c, peraeon sternites 1 and 2, male, Sta. Marta Island, Colombia; d, ditto, Gran Roque Island, Venezuela; e, ditto, Marion County, Florida; f, ditto, Lake Pontchartrain, Louisiana; g, ditto, Caroni Swamp, Trinidad; h, ditto, Baffin Bay, Texas; i, ditto, Caroni Swamp, Trinidad; j, uropod 3, male, Caroni Swamp, Trinidad.

variations would probably not constitute as great a barrier to dispersion for this species as they would for the more stenohaline members of the genus. It would seem realistic therefore, at present, to refer all the Caribbean and Gulf material of *Grandidierella* studied in the present investigations to a single, widely distributed species, which is subject to local variations, possibly subspeciation, throughout the region.

Material collected by the author at Msasani Bay, Tanzania, and material described under the name *G. bonnieri* Stebbing by Ruffo (1958) from Soalara, Madagascar, does not differ significantly from Caribbean and Gulf material; any minor dissimilarities, such as the forward-projecting, rather than rear-facing sternal spine on peraeon segment 1, probably fall within the expected limits of intraspecific variation. There is also good agreement between Caribbean and Gulf material and that attributed by Chilton (1921) to *G. megnae*, by Schellenberg (1928) to *Unciolella lunata*, and by Barnard (1935, 1952) and Nayar (1959) to *G. bonnieri.* Barnard (1958) described a backwardly directed spiniform process on the inner side of coxa 2 in *G. bonnieri*, and this occurs also in Tanzanian, Caribbean, and Gulf of Mexico material examined by the writer.

It would appear, therefore, that all the above material is conspecific. Tubicolous amphipods are often widely dispersed; many undoubtedly are transported among the fouling of ships. This means of dispersal may well be responsible for the wide range of this species, which is now known to occur on both sides of the Atlantic and Indian oceans.

The question remains as to whether this material is conspecific with *G. bonnieri* Stebbing. Syntype material of *G. bonnieri* (B.M.N.H.) is poorly preserved, and there are two males only, one headless, the other consisting of head and peraeon only. Nevertheless, this material differs from all other specimens studied in the present investigations in a number of important characters. The oval-shaped article 5 of gnathopod 1 has the posterior margin produced into a *single* slender tooth and lacks accessory teeth, as in *G. megnae* (Giles). The lack of accessory teeth does not appear to be due to immaturity, for none of the immature specimens studied in the present work has a gnathopod 1 resembling that of Stebbing's syntypes. Another feature of Stebbing's material of *G. bonnieri* is that gnathopod 2 has article 5 scarcely longer, rather than much longer, than article 6 (cf., Fig. 1, d). Further, uropod 3 has the ramus broad, spatulate, almost as figured by Tattersall (1922) for *G. megnae* (Giles), whereas in all other material examined in the present work, the ramus is slender and rodlike (Fig. 2, j). The distinctive characters of the syntypic material strongly suggest that the Caribbean material, together with the African and Indian material discussed above, is distinct from *G. bonnieri* Stebbing, and that the name *G. bonnieroides* Stephensen should be retained for that species for which the synonymy thus becomes:

*Grandidierella bonnieroides* Stephensen, 1948

*Grandidierella megnae*, Chilton, 1921: 548-552, fig. 10 a-l.—Stephensen, 1933: 434-435.—Shoemaker, 1935: 70.
(non) *Grandidierella megnae* (Giles) Tattersall, 1922: 455-456, pl. 19, figs. 1-12.
*Unciolella lunata*, Schellenberg, 1928: 669-671, fig. 207.
(non) *Unciolella lunata* Chevreux, 1910: 264-266, fig. 16, pl. 10, figs. 5-16.
*Grandidierella bonnieri*, Barnard, 1935: 299; 1951: 708; 1952: 279-280, fig. 1.—Panikkar & Aiyar, 1937: 294.—Schellenberg, 1938b: 215-217.—Shoemaker, 1948: 11, fig. 3.—?Monod, 1951: 150-151, figs. 20-22.—Ruffo, 1958: 58-60, figs. 8-9.—Nayar, 1959: 38-39, pl. 14, figs. 1-5; 1965: 161-162, fig. 17f.
(non) *Grandidierella bonnieri* Stebbing, 1908: 120-123, pl. 6.
*Grandidierella bonnieroides* Stephensen, 1948: 12-16, fig. 3.

The writer has not had the opportunity of examining true *G. megnae* (Giles), so no attempt has been made to determine the relationship of that species with *G. bonnieri* Stebbing.

*Material Examined.*—*G. bonnieroides* Stephensen: Gran Roque, Los Roques Islands, Venezuela, 10. 4. 1954, F. Martin, 3 ♂♂; Tortola Island, British West Indies, 17. 4. 1956, Smithsonian-Bredin Exped., 6 ♂♂, 3 ♀♀; Caroni Swamp, Trinidad, 1967, P. R. Bacon, 17 ♂♂, 25 ♀♀, 22 immature; Port St. Joe, Florida, 31. 7. 1939, L. Hubricht, 2 ♂♂, 2 ♀♀; Salt Spring, Marion Co., Florida, 9. 9. 1949, W. McLaine, 5 ♂♂, 8 ♀♀, 7 immature; from *Platophrys ocellata*, Florida, Williams, fragments of ♂♂ & ♀♀; Lake Pontchartrain, Louisiana, 11 ♂♂, 2 ♀♀, 1 immature; Riviera Beach, Baffin Bay, Texas, 9. 5. 1950, M. D. Burkenroad, 2 ♂♂, 8 ♀♀, 2 immature; Marguerita Island, Venezuela, 25. 1. 1896, Chazalie Exped., 1 ♂; Sta. Marta Island, Colombia, 29. 2. 1896, Chazalie Exped., 2 ♂♂, 3 ♀♀; "West Indies," 2 ♂♂, 3 ♀♀; Msasani Bay, Tanzania, 10-20. 12. 68, A. A. Myers, 27 ♂♂, 39 ♀♀, 117 immature.

*G. bonnieri* Stebbing: Port Canning, Lower Bengal, N. Annandale (T. R. R. Stebbing, Coll.), 2 incomplete ♂♂ and a number of incomplete ♀♀ (syntype material).

*Grandidierella perlata* Schellenberg, 1938

*Grandidierella perlata* Schellenberg, 1938a: 91-92, fig. 46 a-d.

*Material Examined.*—Rota, Marianas Islands, in the headwaters of a stream, among wet moss, 6-8. 11. 1945, D. G. Frey, 6 ♂♂, 27 ♀♀.

*Remarks.*—Formerly known only from the type-locality (Fiji) in Polynesia, the known distribution of the species is now extended to Micronesia.

**Grandidierella dentimera,** sp. nov.
Figs. 3-4

*Holotype.*—United States National Museum 123124, male, 5.5 mm.

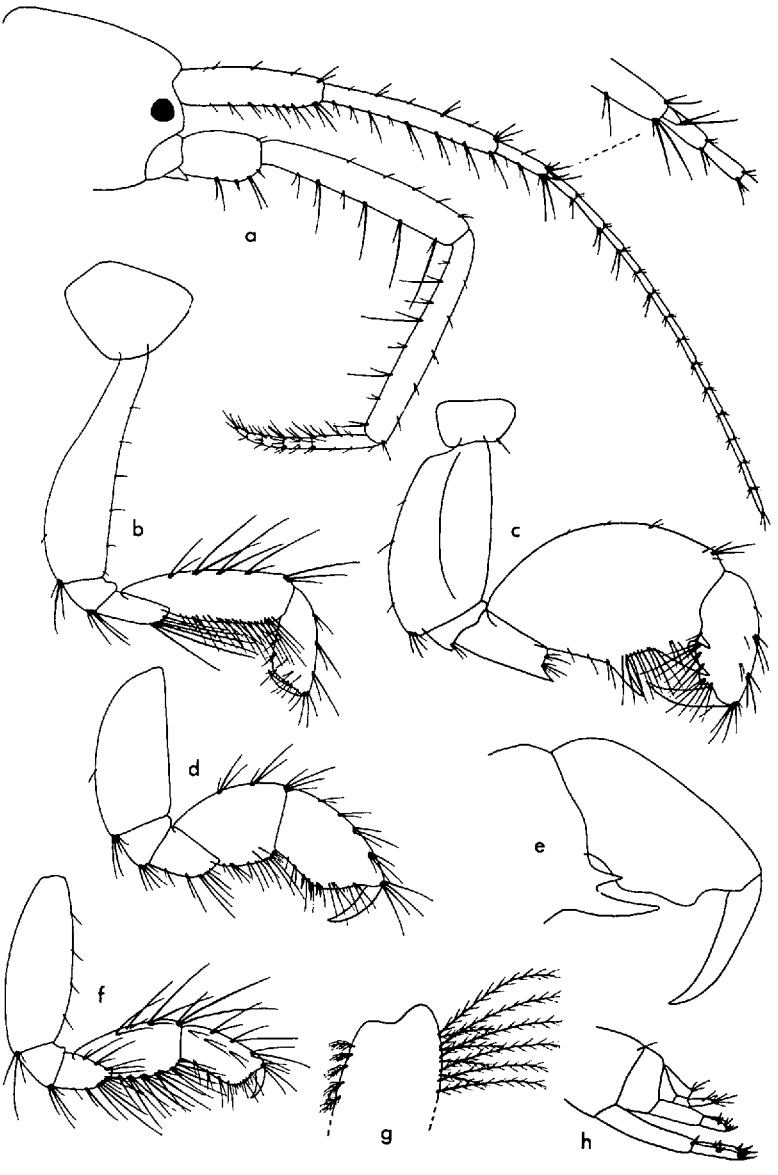


FIGURE 3. *Grandidierella dentimera*, sp. nov.: a, head, male paratype; b, gnathopod 2, male holotype; c, gnathopod 1, male holotype; d, gnathopod 1, female paratype; e, gnathopod 1, articles 6 and 7, male paratype; f, gnathopod 2, female paratype; g, peraeopod 7, proximal portion of article 2, male paratype; h, urosome, lateral view, male paratype.

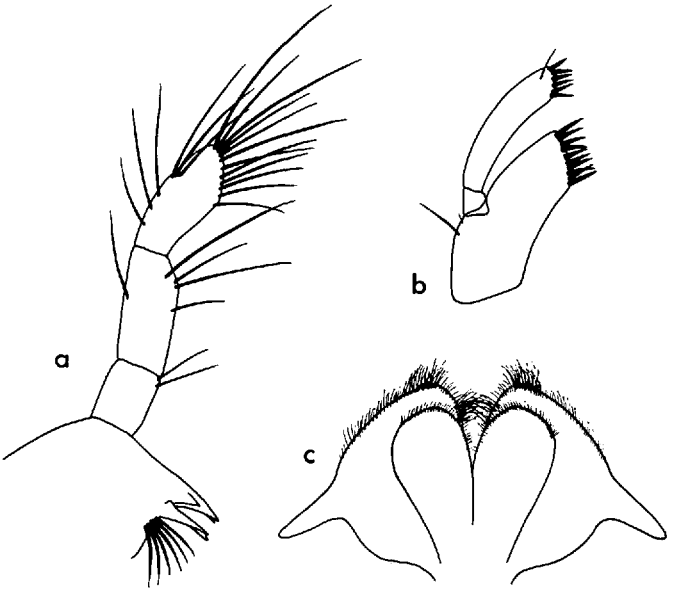


FIGURE 4. *Grandidierella dentimera*, sp. nov.: a, mandibular palp, male paratype; b, maxillule, male paratype; c, paragnath, male paratype.

*Type-Locality.*—Hawaii.

*Material Examined.*—4♂♂, 10♀♀, from two stations.

*Diagnosis of Male.*—Mouthparts similar to those figured by Coutière (1904) for *G. mahafalensis* Coutière, but the mandibular palp (Fig. 4, a) with article 1 short, articles 2-3 longer, subequal. *Eye* small, round. *Antennule* two-thirds the body length, slender, with flagellum of 14-16 articles; accessory flagellum vestigial. *Antenna* moderately stout, subpediform, flagellum of 4-6 articles. *Gnathopod* 1 article 2 very robust, excavate on anterior margin for reception of article 5 when folded; article 4 with the posterior distal margin produced into a short stout tooth; article 5 ovoid with the posterior margin produced into three teeth, two of which arise at the posterior distal angle, the more proximal the longer and slightly inwardly curved, while the third arises basal to these on the posterior margin, being an extension of the margin, not arising within (lateral to) the posterior margin (cf., *G. bonnieroides* Stephensen); article 6 short, broad, the posterior margin bilobed; article 7 equal to the length of article 6. *Gnathopod* 2 article 2 extremely slender; article 5 slender, the posterior margin densely setose; article 6 considerably shorter than 5 and broadening

TABLE 2

RELATIVE LENGTHS OF MANDIBULAR PALP ARTICLES IN SOME SPECIES OF *Grandidierella* AND RELATED GENERA

| Species | Approximate ratio of mandibular palp articles* |
|---|---|
| *Grandidierella megnae* (Giles) | ? 1 : 1 : 1 |
| *G. perlata* Schellenberg | 4 : 5 : 6 |
| *G. bonnieri* Stebbing | 5 : 5 : 6 |
| *G. mahafalensis* Coutière | 5 : 5 : 6 |
| *G. bonnieroides* Stephensen | 5 : 8 : 8 |
| *G. dentimera*, sp. nov. | 5 : 8 : 8 |
| *G. elongata* Chevreux | 1 : 4 : 2 |
| *Neomicrodeutopus cabindae* Schellenberg | 1 : 4 : 2 |
| *Chevreuxius grandimanus* Bonnier | 1 : 4 : 7 |

* Ratio of articles given in basidistal order.

somewhat distally. *Peraeopods* 6-7 each with article 2 having long plumose setae on the posterior margin and much shorter plumose setae on the anterior margin. *Uropod* 1 with two moderately long, subequal rami. *Uropod* 2 with two very short subequal rami. *Uropod* 3 with a single short ramus.

*Diagnosis of Female.—Gnathopod* 1 robust, article 2 broad, the anterior margin slightly excavate; articles 5 and 6 broad, subequal in length, article 6 with the palm delimited proximally by four movable spines; article 7 equal in length to the palm. *Gnathopod* 2 relatively slender, article 6 slightly longer than article 5, article 6 with the palm well defined; article 7 short, equal to the palm.

*Relationships.—G. dentimera*, sp. nov., resembles *G. gravipes* Barnard (particularly as figured by Chilton, 1925) and *G. africana* Schellenberg in the form of the male gnathopod 1. As in those species, *G. dentimera*, sp. nov., has article 2 of gnathopod 1 very expanded, article 6 relatively broad, and article 5 with two teeth at the posterior distal angle, of which the more proximal is the longer and inwardly curved. It differs from these two species, however, in having a tooth on article 4 and a single long marginal tooth on article 5, not a series of short teeth as in *G. gravipes*, or no teeth as in *G. africana*. *G. dentimera*, sp. nov., also differs from *G. gravipes* in having a straight and not uncinately curved uropod 3 ramus, and from *G. bonnieroides* in the form of the male gnathopod 1, particularly the very expanded article 2, broad article 6, and the configuration of the teeth of article 5.

Another feature which may be of some taxonomic value is the relative

lengths of the mandibular palp articles. Present material has article 1 short and articles 2 and 3 subequal as in *G. bonnieroides* Stephensen. In contrast, in the type-species of the genus *Grandidierella* (*G. mahafalensis* Coutière), articles 1 and 2 are subequal, and article 3 is a little longer. Table 2 illustrates the relative lengths of mandibular palp articles in species of *Grandidierella* and related genera as described in the literature.

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SUMMARY

Examination of specimens of *Grandidierella* from a wide range of localities in the Gulf of Mexico and the Caribbean indicates that it is realistic, at present, to refer all the material from these regions, previously attributed by workers to either *G. bonnieri* Stebbing or *G. bonnieroides* Stephensen, to a single, widely distributed species that is subject to local variation and possibly subspeciation throughout the region. Furthermore, American material is shown to be synonymous with material collected by the author in Tanzania and that described by various workers from Africa, Madagascar, and India. The name *G. bonnieroides* Stephensen is retained for this material, which is shown to differ from the type material of *G. bonnieri* Stebbing in a number of significant characters.

*Grandidierella dentimera*, sp. nov., from Hawaii is fully described and figured, and its relationships with other members of the genus are discussed. Finally, the known geographical distribution of *G. perlata* Schellenberg is extended to Micronesia.

SUMARIO

ESTUDIOS TAXONÓMICOS DEL GÉNERO *Grandidierella* COUTIÈRE (CRUSTACEA: AMPHIPODA) CON UNA DESCRIPCIÓN DE *G. dentimera*, SP. NOV.

El examen de ejemplares de *Grandidierella* procedentes de una amplia distribución de localidades en el Golfo de México y el Caribe indica que es realístico, en el presente, referir todo el material de estas regiones, previamente atribuído por otros autores a *G. bonnieri* Stebbing o a *G. bonnieroides* Stephensen, a una sola y ampliamente distribuída especie que está sujeta a variaciones locales y posible subespeciación a través de toda la región. Aún más, material procedente de América se demuestra que es sinónimo del material colectado por el autor en Tanzania y del descrito por varios otros autores de Africa, Madagascar e India. El nombre *G. bonnieroides* Stephensen es retenido para este material, que se demuestra

difiere del material tipo de *G. bonnieri* Stebbing en un número de caracteres significativos.

*Grandidierella dentimera* sp. nov. de Hawaii es totalmente descrita e ilustrada y se discuten sus relaciones con otros miembros del género. Finalmente, la distribución geográfica conocida de *G. perlata* Schellenberg se extiende hasta Micronesia.

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